Received: 15 July 2023 | Revised: 21 August 2023 | Accepted: 22 August 2023

DOI: 10.1111/aec.13430

NATURAL HISTORY NOTE

Records of the land planarian *Polycladus gayi* (Tricladida, Geoplanidae) preying on black snails *Macrocyclis peruvianus* (Gastropoda, Macrocyclidae)

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Abstract

Polycladus gayi is a colourful and easily recognizable land planarian native to the temperate to cold rainforests of the west coast of southern South America, in Chile and Argentina; however, its ecology is poorly understood. Here, we describe the first records of *P. gayi* preying on a black snail *Macrocyclis peruvianus* in the wild. Two events were recorded, the first in a healthy forest in Llancahue Alto, Panguipulli, Chile, during the austral summer of 2023, and the second in a mature evergreen forest in the coastal range of La Union, Chile. These records expand our knowledge of the feeding habits and behaviour of *P. gayi* and add *M. peruvianus* to its prey list.

KEYWORDS

Geoplaninae, land flatworms, Platyhelminthes, predation, soil ecology

INTRODUCTION

Land planarians are carnivorous, free-living flatworms that prey on other invertebrates (Cseh et al., 2017; Winsor et al., 1998), including gastropods (Boll & Leal-Zanchet, 2015, 2016), although some species are primarily scavengers (Boll et al., 2015). In Chile, Neotropical land planarians (Tricladida: Geoplaninae) consist of 27 known species (Almeida et al., 2021; Grau et al., 2022). However, the total species richness is certainly much higher, and several species have been recently described (Almeida, Álvarez-Presas, Bolonhezi, & Carbayo, 2022; Almeida, Álvarez-Presas, & Carbayo, 2022; Grau et al., 2022). Nevertheless, the ecology and behaviour of land planarians, including their feeding habits, are still poorly known.

The land planarian *Polycladus gayi*, known in Spanish as *lengua de vaca* (“cow tongue”), is recognizable due to its large size, reaching more than 140 mm in length (Schneider, 1934), and having a very wide and flat body. It has a shiny black dorsal colour with a golden yellow to orange stripe running on each side (Almeida, Álvarez-Presas, & Carbayo, 2022; Barahona-Segovia et al., 2020; Grau & Carbayo, 2010). It is one of the longest native land planarians in the Southern Cone (Barahona-Segovia et al., 2020) and the widest-known in the world (Almeida, Álvarez-Presas, & Carbayo, 2022). It inhabits the leaf litter of native forests inside public and private protected areas at medium altitudes between the regions of Bío-Bío and Aysén in Chile, as well as in adjacent forests in Argentina (Barahona-Segovia et al., 2020). Despite being such a remarkable species, *P. gayi* has rarely been recorded attacking, preying on, or ingesting

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other invertebrates. Herein, we report two events of *P. gayi* preying on black snails, *Macrocyclis peruvianus*, the only extant representative of the family Macrocyclidae (Salvador et al., 2021). This snail is found in Chile, between the Maule and Aysén regions, and in neighbouring areas of Argentina, in the Neuquén province and the Bariloche department of the Río Negro province, overlapping with the known distribution of *P. gayi* (Barahona-Segovia, 2019; Salvador et al., 2021). It is associated with healthy cordilleran and coastal forests (Gómez et al., 2020), found in the forest soil among ferns, moss, liverworts and even under fallen logs (Silva & Thomé, 2009). The shell is recognizable by its shape and size: depressed, with whorls rapidly increasing in size, reaching 50–60 mm in diameter (Salvador et al., 2021; Silva & Thomé, 2009). Similar to the case of *P. gayi* and other invertebrates of Chilean forests, the ecology of *M. peruvianus* is poorly known.

METHODS

Reports were obtained from occasional trails on National Parks in the Los Lagos Region. On 11 March 2023, the Ko-habitantes Collective conducted a collaborative excursion to study the local wildlife of Panguipulli, heading towards Laguna Azul (39°31′55″ S; 71°45′6″ W), 1590 m a.s.l. within the Villarrica National Park, at the flank of the Quetrupillán Volcano, in the Los Ríos Region (Figure 1). The path was taken by foot, starting at km 18 towards Los Cajones, Coñaripe, Llancahue Alto Sector. Additionally, on 29 May 2023, a park ranger, together with a team of Seterial Humedal Punucapa, visited a trail of the Alerce Costero National Park (Figure 1), a protected area in the Coastal Range of La Unión and Corral, Los Ríos Region.

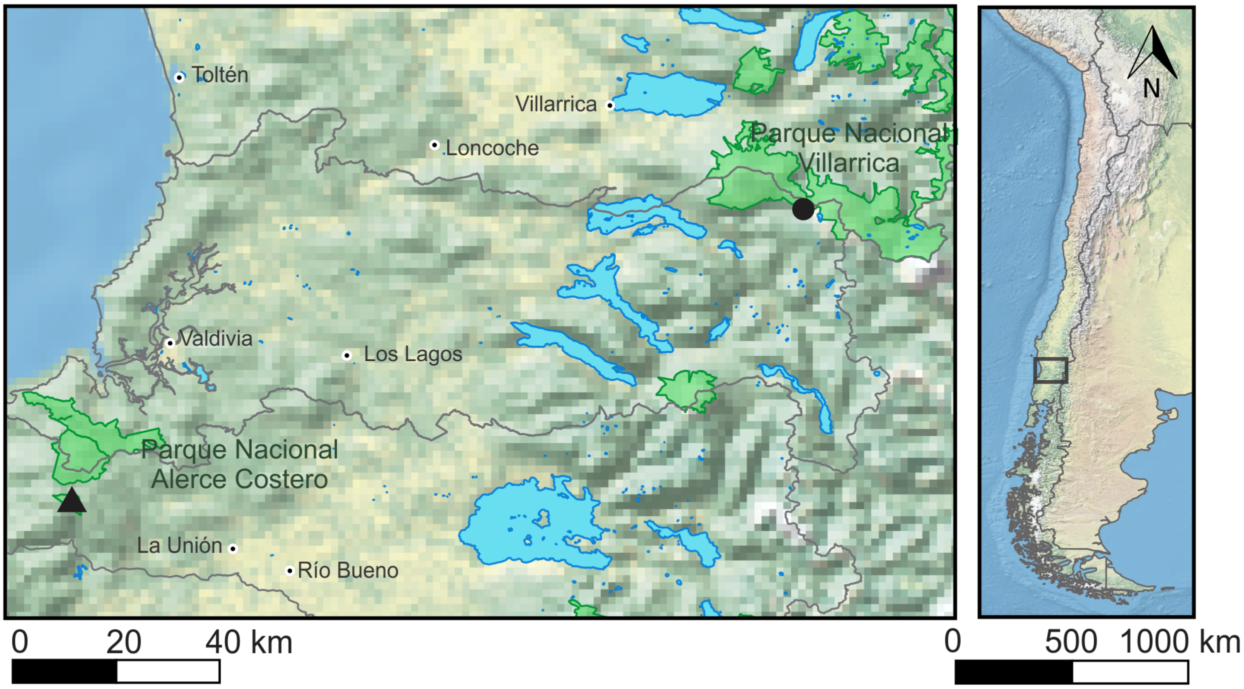

FIGURE 1 Locations where specimens of *Polycladus gayi* were found preying on *Macrocyclis peruvianus*. Circle: Llancahue Alto sector, Villarrica National Park, Panguipulli; Triangle: Lañilahual trail, Alerce Costero National Park, La Unión, Los Ríos Region, Chile.

RESULTS

In the Villarrica National Park, one specimen of *P. gayi* was found surrounding the shell of *M. peruvianus* (Figure 2a). The gastropod was about 35 mm wide and the planarian about 129 mm long while motionless around the shell. The finding occurred on 11 March 2023 at 13:10 in the Llancahue Alto trail (Figure 1, 39°31′15.4″ S; 71°47′34.5″ W, 1025 m a.s.l.) towards Laguna Azul, in a section of an old-growth forest dominated by *Nothofagus dombeyi*, *N. alpina* and *Chusquea quila*. The recorded temperatures of that day varied from 9 to 24°C. The event was observed for about 10 min, during which neither the planarian nor the snail appeared to move. A mucus trail, about 30 cm long, was seen over the leaf litter and indicated where the capture of the snail likely started. Both animals were repositioned at a safe place near the trail to safeguard them. On the following day, at 13:30, therefore 24 h after finding the animals, the planarian was found with the median part of its anterior portion notably swollen, suggesting that its intestine was filled with the remains of the ingested prey. The planarian measured 221 mm in length while creeping (Figure 2b, Appendix S1). The empty shell of *M. peruvianus* was found nearby (Figure 2c). No other large-sized planarian or gastropod was seen on the trail. The identification of the species was confirmed by peers on iNaturalist (https://www.inaturalist.org/observations/151048504).

In the Alerce Costero National Park, another specimen of *P. gayi* was observed surrounding a specimen of *M. peruvianus* on 29 May 2023 at 15:07. The finding occurred at the Lañilahual trail (Figure 1, 40°11′43.4″ S; 73°27′8.88″ W, 725 m a.s.l.) in a mature evergreen forest with trees of the family Myrtaceae, as well as *Nothofagus* spp. and *Fitzroya cupressoides*. The temperature was about 8°C. The event was observed for about 10 min, after which the planarian started to move, and the team decided to leave so as not to disturb the animal further. Two days later, an empty shell of *M. peruvianus* was found at the same site, suggesting total predation of the snail by the planarian (Appendix S2).

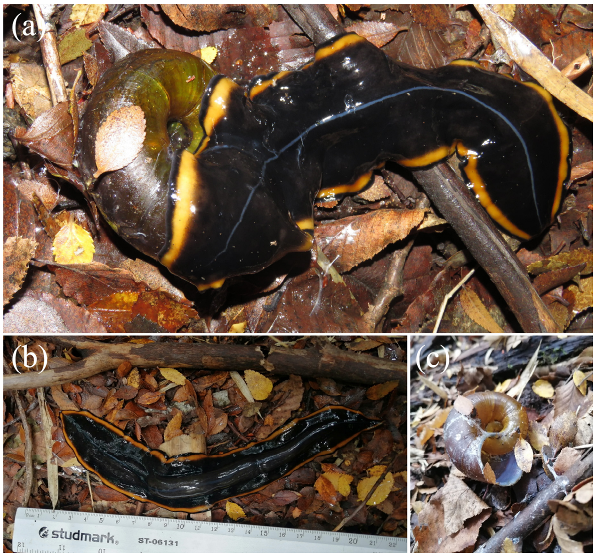

FIGURE 2 Photographic record of the land planarian *Polycladus gayi* feeding on the snail *Macrocyclis peruvianus*, in Panguipulli, the Los Ríos Region, Chile. (a) Planarian with the body attached to the snail's shell, (b) the same specimen found 24 h later at the same site and showing the intestine filled with food, anterior end pointing to the right, and (c) empty shell of the snail after the predation event.

DISCUSSION

Both *Polycladus gayi* and *Macrocyclis peruvianus* are easily recognizable species but poorly studied. Our records seem to be the first observations of predation by *P. gayi* in the wild, as well as the first records of *M. peruvianus* as prey. Goetsch (1933) was the first to observe *P. gayi* feeding on a snail that was offered to it, but the snail species was not identified, only described as having a size similar to that of *Cepaea hortensis*. Therefore, the record of these events is a valuable addition to our knowledge of the ecology of land planarians and the dynamics of soil communities in Chilean temperate rainforests. In both cases, the planarian was found covering part of the shell opening of the snail and likely captured it after following its mucus trail, similar to how other snail-eating land planarians capture their prey (Boll & Leal-Zanchet, 2015, 2018a). The behaviour observed in *P. gayi* resembles that seen in snail-eating species of the genus *Obama* (Geoplaninae) from Brazil. Species of this genus usually attach their anterior end to the prey soon after touching it, then surround it with their body to position their mouth near the shell opening. The pharynx is protruded and inserted into the snail's soft tissue to start sucking its contents (Boll & Leal-Zanchet, 2018b; Froehlich, 1955).

The morphometrics of land planarians, such as the position of the dorsal insertion of the pharynx, and the thickness of the cutaneous musculature can help identify potential prey of geoplaninid land planarians and answer ecological questions (Boll & Leal-Zanchet, 2022). The organization and thickness of the cutaneous musculature layers in *P. gayi* were briefly characterized by Graff (1899) and more were provided by Grau (2010), where the cutaneous musculature is described as relatively thick, especially regarding the transversal and longitudinal layers, when compared to other broad and flat neotropical land planarians (Boll & Leal-Zanchet, 2022). Under laboratory conditions, many land planarians have a specialist diet, and species with very wide bodies usually only feed on terrestrial gastropods (Boll & Leal-Zanchet, 2016), and this could be the case for *P. gayi*. Other large-sized gastropods co-occurring with *P. gayi* are *Plectostylus araucanus*, *Plectostylus vagabondiae* and *Phyllocaulus gayi*, common in native forests and forest fragments (Barahona-Segovia, 2019). It is possible that *P. gayi* also preys on these species but, since land planarians can show some selectivity regarding their prey (Boll & Leal-Zanchet, 2016), one cannot affirm it without evidence. Several European gastropods have been introduced in Chile, viz. *Cornu aspersum*, *Oxychilus* spp., *Deroceras reticulatum*, *Arion intermedius* and *Limax maximus* (Cádiz et al., 2013; Landler & Nuñez, 2012; PNUD, 2014), and the possibility of *P. gayi* acting as a biological control against them should be investigated since native Neotropical land planarians have this potential (Boll & Leal-Zanchet, 2015). Although the ecology of land planarians is still poorly known worldwide, they are very important predators of the soil fauna, as demonstrated by invasive species that have devastating effects on prey species that are not adapted to environments with such predators (Murchie & Gordon, 2013; Ohbayashi et al., 2007).

Many land planarians are sensitive to changes in temperature and humidity of the environment (Carbayo et al., 2002), and this is expected in the case of *P. gayi* as well. Both species, *P. gayi* and *M. peruvianus*, are threatened by habitat degradation and climate change (Barahona-Segovia, 2019; Barahona-Segovia et al., 2020; Gómez et al., 2022), and the maintenance of their populations could be influenced by the conservation of the Villarrica and Alerce Costero National Parks (Negrete et al., 2014).

AUTHOR CONTRIBUTIONS

Piter K. Boll: Data curation (equal); resources (equal); supervision (equal); validation (equal); writing – review and editing (equal). **Yerko Lloncón:** Conceptualization (equal); investigation (equal); methodology (lead); resources (lead). **Diego Almendras:** Conceptualization (equal); project administration (lead); supervision (equal); writing – original draft (lead); writing – review and editing (equal).

ACKNOWLEDGEMENTS

We thank the members of Colectiva Ko-Habitantes for their help in the excursion in the Villarrica National Park, Natalia Vidal, for her assistance and company, and Pablo Silva for his cooperation on iNaturalist. We also thank Francisco Javier Noriega Delgado, Rodrigo Jerez and Javiera Flores for recording the predation event in the Alerce Costero National Park and allowing us to use the data in this paper.

FUNDING INFORMATION

This work was conducted without external funding.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicting interests that influenced this work.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Boll, P.K., Lloncón, Y. & Almendras, D. (2023) Records of the land planarian *Polycladus gayi* (Tricladida, Geoplanidae) preying on black snails *Macrocyclis peruvianus* (Gastropoda, Macrocyclidae). *Austral Ecology*, 00, 1–7. Available from: https://doi.org/10.1111/aec.13430